FORM PTO-1390 (Modified) (REV 11-2000) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER: L9289.01141

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR): 09/856553

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/JP00/06689	September 28, 2000	October 1, 1999

TITLE OF INVENTION
SPEECH CODER AND SPEECH CODING METHOD

APPLICANT(S) FOR DO/EO/US
Tadashi YONEZAKI

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include itens (5), (6), (9) and (24) indicated below.
4. ☐ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
   a. ☐ is attached hereto (required only if not communicated by the International Bureau).
   b. ☒ has been communicated by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
   ☒ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. ☒ is attached hereto.
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
   ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
   a. ☐ are attached hereto (required only if not communicated by the International Bureau).
   b. ☐ have been communicated by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.
   ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
   ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
   ☐ An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).
   ☐ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☒ A copy of the International Search Report (PCT/ISA/210).

Items 13 to 20 below concern document(s) or information included:

13. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☐ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
20. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
21. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
22. ☐ Certificate of Mailing by Express Mail
23. ☒ Other items or information:

Claim for Priority with PCT/IB/304
PCT/IB/308
PCT/RO/101

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
09/856553	PCT/JP00/06689	L9289.01141

24. The following fees are submitted:	CALCULATIONS	PTO USE ONLY
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :		
☐ Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO **$1000.00**		
☒ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO **$860.00**		
☐ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO **$710.00**		
☐ International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) **$690.00**		
☐ International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) **$100.00**		
ENTER APPROPRIATE BASIC FEE AMOUNT =	**$860.00**	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).	**$0.00**	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	13 - 20 =	0	x $18.00	**$0.00**	
Independent claims	7 - 3 =	4	x $80.00	**$320.00**	
Multiple Dependent Claims (**check if applicable**).			☐	**$0.00**	
TOTAL OF ABOVE CALCULATIONS =				**$1,180.00**	
Applicant claims small entity status. (See 37 CFR 1.27). The fees indicated above are reduced by 1/2.				**$0.00**	
SUBTOTAL =				**$1,180.00**	
cessing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 nths from the earliest claimed priority date (37 CFR 1.492 (f)). +				**$0.00**	
TOTAL NATIONAL FEE =				**$1,180.00**	
for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be ompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (**check if applicable.** ☒				**$40.00**	
TOTAL FEES ENCLOSED =				**$1,220.00**	
				Amount to be: refunded	$
				charged	$

a. ☒ A check in the amount of **$1,220.00** to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. _____ in the amount of _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **19-4375** A duplicate copy of this sheet is enclosed.

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

James E. Ledbetter, Esq.
Stevens,Davis, Miller & Mosher, LLP
1615 L Street, NW, Suite 850
Washington, DC 20036
Tel: (202) 785-0100
Fax: (202) 408-5200

SIGNATURE

James E. Ledbetter
NAME

28,732
REGISTRATION NUMBER

May 23, 2001
DATE

DESCRIPTION

SPEECH CODER AND SPEECH CODING METHOD

Technical Field

The present invention relates to a speech coder and speech coding method used for a communication apparatus in a radio communication system such as car telephone and cellular telephone.

Background Art

In the field of radio communication systems, which is drastically growing in demand in recent years, the development of apparatuses capable of coding speech at a low bit rate and with high quality is underway for the effective utilization of radio wave resources.

FIG.1 is a block diagram showing a configuration of a conventional speech coder.

In FIG.1, noise section detection section 11 separates an input signal into a speech section and non-speech section and detects signals outside the speech section as background noise. Noise model estimation section 12 estimates a noise model such as an amplitude frequency characteristic of a noise signal in the noise section detected by noise section detection section 11.

Noise elimination section 13 eliminates noise from the input signal using the noise model estimated by noise

model estimation section 12. When an amplitude frequency characteristic is used as the noise model, it is possible to eliminate noise using a spectral subtraction method, etc. Information on noise elimination processing is described in the Unexamined Japanese Patent Publication No.HEI 10-133689 and the Unexamined Japanese Patent Publication No.HEI 10-187193, etc.

Speech analysis section 14 analyzes the signal stripped of noise, which is the output of noise elimination section 13, and extracts parameters.

Parameter quantization section 15 quantizes the parameters extracted by speech analysis section 14 and extracts and outputs a code corresponding to a minimum error based on one scale represented by an Euclidean distance as a code corresponding to the quantized value.

As shown above, the conventional speech coder implements speech coding at a low bit rate and with high quality by eliminating the noise signal component from the input signal and extracting parameters specific to the speech signal.

However, the conventional speech coder above has noise signal component elimination processing independent of speech coding processing, and therefore the ability to eliminate the noise signal component is greatly dependent on the accuracy of a noise model, thus having a problem that the quality deteriorates in a background noise environment.

Disclosure of Invention

It is an object of the present invention to provide a speech coder and speech coding method less dependent on the accuracy of a noise model, resistant to a noise signal component and capable of implementing high quality speech coding processing even in a background noise environment.

This object is attained by executing parameter quantization using the magnitude of noise or noise model and information source model.

Brief Description of Drawings

FIG.1 is a block diagram showing a configuration of a conventional speech coder;

FIG.2 is a block diagram showing a configuration of a speech coder according to Embodiment 1 of the present invention;

FIG.3 is a block diagram showing an internal configuration of a parameter quantization section of the speech coder according to the embodiment above;

FIG.4 is a block diagram showing a configuration of a speech coder according to Embodiment 2 of the present invention;

FIG.5 is a block diagram showing an internal configuration of a parameter quantization section of the speech coder according to Embodiment 2 of the present invention;

FIG.6 is a block diagram showing an internal configuration of a parameter quantization section of a speech coder according to Embodiment 3 of the present invention; and

FIG.7 is a block diagram showing an internal configuration of a parameter quantization section of a speech coder according to Embodiment 4 of the present invention.

Best Mode for Carrying out the Invention

With reference now to the attached drawings, embodiments of the present invention will be explained below.

(Embodiment 1)

FIG.2 is a block diagram showing a configuration of a speech coder according to Embodiment 1 of the present invention.

In FIG.2, noise section detection section 101 separates an input signal into a speech section and non-speech section and detects signals outside the speech section as background noise. Noise level estimation section 102 estimates the noise level (magnitude of noise) in the noise section detected by noise section detection section 101.

Information source model storage section 103 stores an information source model, which models a

parameter string for a speech input signal without noise. Speech analysis section 104 analyzes the input signal and extracts parameters.

Parameter quantization section 105 quantizes the parameters extracted by speech analysis section 104 based on the information source model and noise level and outputs a code corresponding to the quantized value.

FIG.3 is a block diagram showing an internal configuration of parameter quantization section 105 of the speech coder according to this embodiment.

In FIG.3, tolerance level determinator 201 determines a tolerance according to the noise level estimated by noise level estimation section 102.

Codebook 202 stores quantized values corresponding to transmission codes. Code extractor 203 extracts codes whose errors from the parameters extracted by speech analysis section 104 are equal to or less than the tolerance from codebook 202.

Code selector 204 selects the most likely code as a transmission code from among the codes extracted by code extractor 203 based on the information source model.

Thus, by extracting transmission code candidates from parameters according to a noise level and determining a final transmission code based on the information source model, it is possible to implement speech coding processing resistant to a noise signal component and of high quality even in a background noise environment without deteriorating the performance for

signals without noise.

(Embodiment 2)

FIG.4 is a block diagram showing a configuration of a speech coder according to Embodiment 2 of the present invention. The speech coder in FIG.4 adopts a configuration including noise model estimation section 301 instead of noise level estimation section 102 compared to FIG.2.

In the speech coder in FIG.4, the components common to those in FIG.2 are assigned the same reference numerals as those in FIG.2 and explanations thereof are omitted.

Noise model estimation section 301 estimates a noise model such as an amplitude frequency characteristic of a noise signal in the noise section detected by noise section detection section 101.

Parameter quantization section 105 quantizes parameters extracted by speech analysis section 104 based on the likelihood of the parameter string obtained from the information source model and noise model and outputs the code corresponding to the quantized value.

FIG.5 is a block diagram showing an internal configuration of parameter quantization section 105 of the speech coder according to this embodiment. Parameter quantization section 105 in FIG.5 adopts a configuration including tolerance range determinator 401 instead of tolerance level determinator 201 compared

to FIG.3.

In the parameter quantization section 105 in FIG.5, the components common to those in FIG.3 are assigned the same reference numerals as those in FIG.2 and explanations thereof are omitted.

Tolerance range determinator 201 in FIG.5 determines the range of tolerance based on the noise model estimated by noise model estimation section 301. By taking into account the noise model, it is possible to set a variance of the noise superimposing level for every element in vector quantization.

Code extractor 203 extracts codes whose errors from parameters extracted by speech analysis section 104 fall within the tolerance range from codebook 202.

Thus, by extracting transmission code candidates from parameters according to a noise model and determining a final transmission code based on the information source model, it is possible to implement speech coding processing of higher quality than the case where the noise level is used.

(Embodiment 3)

FIG.6 is a block diagram showing an internal configuration of a parameter quantization section 105 of a speech coder according to Embodiment 3 of the present invention.

The configuration of the speech coder according to this embodiment is the same as the configuration of the

speech coder shown in FIG.2 of Embodiment 1, and therefore explanations thereof are omitted.

In FIG.6, error calculation weighting determinator 501 determines weighting on each parameter element in calculating an error between an input parameter and quantized value based on the noise level and information source model estimated by noise level estimation section 102.

For example, when noise excitation is coded according to a CELP speech coding system, weighting is performed in such a way that a parameter element error value having a correlation with the power envelope of the adaptive excitation is reduced.

Codebook 502 stores quantized values corresponding to transmission codes. Quantizer 503 quantizes parameters extracted by speech analysis section 104 according to the weighting determined by error calculation weighting determinator 501 using codebook 502.

Thus, by performing weighting on each parameter element based on a noise level and information source model and quantizing parameters, it is possible to implement speech coding processing resistant to a noise signal component and of high quality even in a background noise environment without deteriorating the performance for signals without noise.

The explanation above describes the case where a noise level is used, but this embodiment can also perform

weighting processing using the noise model described in Embodiment 2.

(Embodiment 4)

FIG.7 is a block diagram showing an internal configuration of parameter quantization section 105 of a speech coder according to Embodiment 4 of the present invention.

The configuration of the speech coder according to this embodiment is the same as the configuration of the speech coder shown in FIG.2 of Embodiment 1, and therefore explanations thereof are omitted.

In FIG.7, code appearance probability calculator 601 estimates the probability that parameter quantized values will appear when no noise is included in an input signal from the noise level estimated by noise level estimation section 102 and an information source model.

Codebook 602 stores quantized values corresponding to transmission codes. Quantizer 603 quantizes parameters extracted by speech analysis section 104 according to the likelihood of the appearance probability estimated by code appearance probability calculator 601 combined with an error value using codebook 602.

Thus, by estimating the appearance probability of parameter quantized values and quantizing parameters based on a noise level and information source model, it is possible to implement speech coding processing

resistant to a noise signal component and of high quality even in a background noise environment without deteriorating the performance for signals without noise.

The explanation above describes the case where a noise level is used, but this embodiment can also perform weighting processing using the noise model described in Embodiment 2.

As described above, the speech coder and speech coding method of the present invention can implement speech coding processing less dependent on the accuracy of a noise model, resistant to a noise signal component and of high quality even in a background noise environment.

This application is based on the Japanese Patent Application No.HEI 11-281466 filed on October 1, 1999, entire content of which is expressly incorporated by reference herein.

Industrial Applicability

The present invention is ideally applicable to a communication apparatus in a radio communication system such as car telephone and cellular telephone.

What is claimed is:

1. A speech coder comprising:

noise section detecting means for detecting the noise section of an input signal;

noise level estimating means for estimating the magnitude of noise in the detected noise section;

information source model storing means for storing an information source model that models a parameter string for a speech input signal without noise;

speech analyzing means for analyzing the input signal and extracting parameters; and

parameter quantizing means for quantizing said extracted parameters based on said information source model and the magnitude of said noise and outputting a code corresponding to the quantized value.

2. The speech coder according to claim 1, wherein the parameter quantizing means determines a tolerance according to the magnitude of noise, extracts codes whose errors from the parameters are equal to or less than said tolerance and selects the most likely code as a transmission code from among said extracted codes based on the information source model.

3. The speech coder according to claim 1, wherein the parameter quantizing means determines weighting on each parameter element when an error between the input

parameter and quantized value is calculated based on the magnitude of noise and information source model and quantizes the parameter according to this determined weighting.

4. The speech coder according to claim 1, wherein the parameter quantizing means estimates the appearance probability of the parameter quantized value from the magnitude of noise and information source model when the input signal contains no noise and quantizes the parameter according to the likelihood of this estimated appearance probability combined with the error value.

5. A speech coder comprising:

noise section detecting means for detecting the noise section of an input signal;

noise model estimating means for estimating a noise model in the detected noise section;

information source model storing means for storing an information source model that models a parameter string for a speech input signal without noise;

speech analyzing means for analyzing the input signal and extracting parameters; and

parameter quantizing means for quantizing said extracted parameters based on said information source model and said noise model and outputting a code corresponding to the quantized value.

6. The speech coder according to claim 5, wherein the parameter quantizing means determines a tolerance range based on the noise model, extracts codes whose errors from the parameters are equal to or less than said tolerance and selects the most likely code as a transmission code from among said extracted codes based on the information source model.

7. The speech coder according to claim 5, wherein the parameter quantizing means determines weighting on each parameter element when an error between the input parameter and quantized value is calculated based on the noise model and information source model and quantizes the parameter according to this determined weighting.

8. The speech coder according to claim 5, wherein the parameter quantizing means estimates the appearance probability of a parameter quantized value when the input signal contains no noise from the noise model and information source model and quantizes the parameter according to the likelihood of this estimated appearance probability combined with the error value.

9. A radio communication apparatus equipped with a speech coder, said speech coder comprising:

noise section detecting means for detecting the noise section of an input signal;

noise level estimating means for estimating the

magnitude of noise in the detected noise section;

information source model storing means for storing an information source model that models a parameter string for a speech input signal without noise;

speech analyzing means for analyzing the input signal and extracting parameters; and

parameter quantizing means for quantizing said extracted parameters based on said information source model and the magnitude of said noise and outputting a code corresponding to the quantized value.

10. A speech coding method comprising the steps of:

detecting the noise section of an input signal;

estimating the magnitude of noise in the detected noise section;

analyzing the input signal and extracting parameters; and

quantizing said extracted parameters based on said information source model that models the parameter string for the speech input signal without noise and the magnitude of said noise and outputting a code corresponding to the quantized value.

11. A speech coding method comprising:

detecting the noise section of an input signal;

estimating a noise model in the detected noise section;

analyzing the input signal and extracting

parameters; and

quantizing said extracted parameters based on the information source model that models a parameter string corresponding to the speech input signal without noise and said noise model and outputting a code corresponding to the quantized value.

12. A mechanically-readable recording medium storing a speech coding program that makes a computer execute the steps of:

detecting the noise section of an input signal;

estimating the magnitude of noise in the detected noise section;

analyzing the input signal and extracting parameters; and

quantizing said extracted parameters based on the information source model that models a parameter string for the speech input signal without noise and the magnitude of said noise and outputting a code corresponding to the quantized value.

13. A mechanically-readable recording medium storing a speech coding program that makes a computer execute the steps of:

detecting the noise section of an input signal;

estimating a noise model in the detected noise section;

analyzing the input signal and extracting

parameters; and

quantizing said extracted parameters based on the information source model that models a parameter string corresponding to the speech input signal without noise and said noise model and outputting a code corresponding to the quantized value.

ABSTRACT

Noise section detection section 101 separates an input signal into a speech section and non-speech section, and detects signals outside the speech section as background noise. Noise level estimation section 102 estimates the noise level in the noise section. Information source model storage section 103 stores an information source model that models a parameter string for the speech input signal without noise. Speech analysis section 104 analyzes the input signal and extracts parameters. Parameter quantization section 105 quantizes the parameters extracted by speech analysis section 104 based on the information source model and noise level and outputs a code corresponding to the quantized value. This makes it possible to implement speech coding processing less dependent on the accuracy of a noise model, resistant to a noise signal component and of high quality even in a background noise environment.

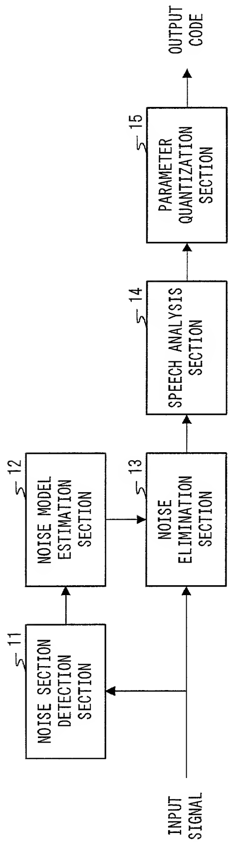
OUTPUT CODE
15
PARAMETER QUANTIZATION SECTION
14
SPEECH ANALYSIS SECTION
12
NOISE MODEL ESTIMATION SECTION
13
NOISE ELIMINATION SECTION
11
NOISE SECTION DETECTION SECTION
INPUT SIGNAL

FIG. 1

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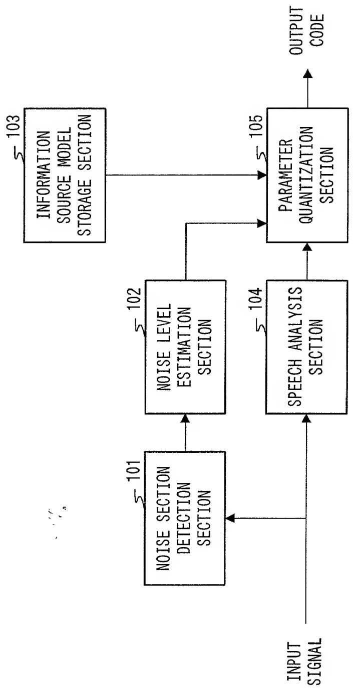

FIG. 2

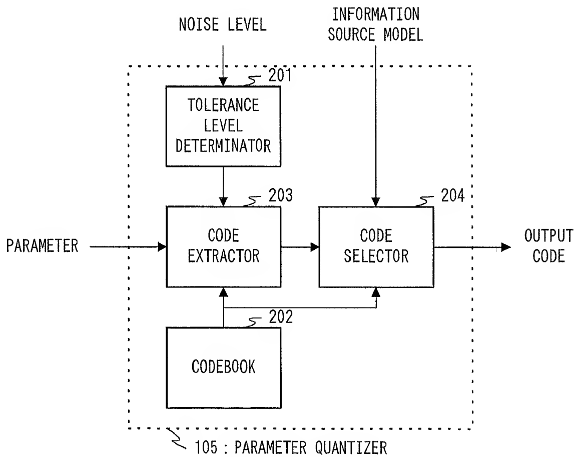
NOISE LEVEL
INFORMATION SOURCE MODEL
201
TOLERANCE LEVEL DETERMINATOR
203
204
PARAMETER
CODE EXTRACTOR
CODE SELECTOR
OUTPUT CODE
202
CODEBOOK
105 : PARAMETER QUANTIZER

FIG. 3

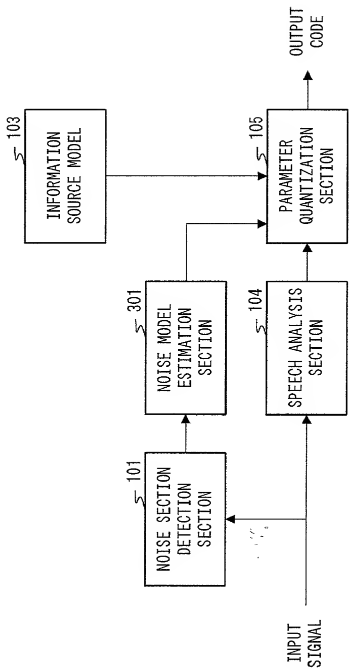
INFORMATION SOURCE MODEL
103
PARAMETER QUANTIZATION SECTION
105
OUTPUT CODE
NOISE MODEL ESTIMATION SECTION
301
SPEECH ANALYSIS SECTION
104
NOISE SECTION DETECTION SECTION
101
INPUT SIGNAL

FIG. 4

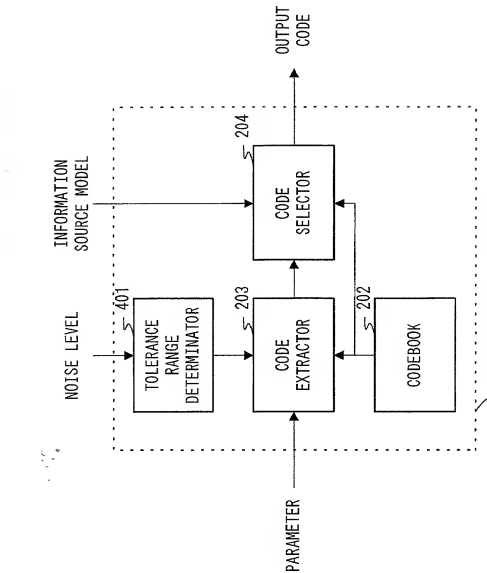
OUTPUT CODE
INFORMATION SOURCE MODEL
NOISE LEVEL
401
TOLERANCE RANGE DETERMINATOR
203
CODE EXTRACTOR
204
CODE SELECTOR
202
CODEBOOK
105 : PARAMETER QUANTIZER
PARAMETER

FIG. 5

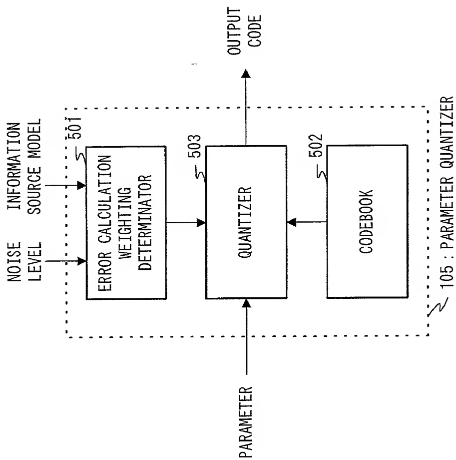
NOISE LEVEL
INFORMATION SOURCE MODEL
501
ERROR CALCULATION WEIGHTING DETERMINATOR
503
QUANTIZER
502
CODEBOOK
OUTPUT CODE
PARAMETER
105 : PARAMETER QUANTIZER

FIG. 6

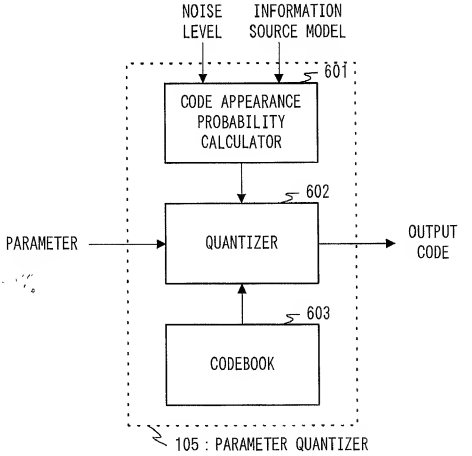
NOISE LEVEL
INFORMATION SOURCE MODEL
601
CODE APPEARANCE PROBABILITY CALCULATOR
602
PARAMETER
QUANTIZER
OUTPUT CODE
603
CODEBOOK
105 : PARAMETER QUANTIZER

FIG. 7

APPLICATION FOR UNITED STATES PATENT
Declaration for Patent Application

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on

the invention entitled: **SPEECH CODER AND SPEECH CODING METHOD**

the specification of which 2 (file no _____)

(check at least one) 3 [X] is attached hereto
4 [ ] was filed on _____ as (5) U.S. Application Serial No. _____
6 [ ] and was amended _____ (if applicable)

Use this portion only if you are entering the U.S. National phase based on a PCT International Application designating the U.S.

7 [x] was filed as PCT international application

8 Number **PCT/JP00/06689**

9 on **September 28, 2000**

and was amended under PCT Article(s) 19 and/or 34

10 on _____ (if applicable).

I hereby declare that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended, by amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me which is material to patentability in accordance with Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application (s) for patent or inventor's certificate listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date earlier than that of the application(s) on which priority is claimed.

Prior (Foreign) Application(s) any Priority Claims Under 35 U.S.C. 119 — Priority Claimed

(Country)	(Number)	(Day/Month/Year Filed)		
JAPAN	**JP11-281466**	**01/October/1999**	[X] Yes	[ ] No
			[ ] Yes	[ ] No

[ ] Additional foreign application numbers are listed on a supplemental priority data sheet attached hereto.

Priority Claim(s) from U.S. Provisional Application(s) – I hereby claim the benefit under Title 35, United States Code, §119(e) of any United States provisional application(s) listed below:

11b	Application No.	Day/Month/Year Filed	Application No.	Day/Month/Year Filed

Do not use this portion to identify a PCT application if the parent application is the U.S. National phase of the PCT application

I hereby claim the benefit under Title 35, United States Code, 120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code §112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56 which became available between filing date of the prior application and the national or PCT international filing date of this application.

13	(U.S. Application Number)	(U.S. Filing Date)	Status (patented, pending, abandoned)

I hereby appoint the following attorneys of the firm of Stevens, Davis, Miller & Mosher, L.L.P. as my attorneys of record with full power of substitution and revocation to prosecute this application and to transact all business in the Patent and Trademark Office:

James E. Ledbetter, Reg. No. 28732; Thomas P. Pavelko, Reg. No. 31689; and Anthony P. Venturino, Reg. No. 31674.

ALL CORRESPONDENCE IN CONNECTION WITH THIS APPLICATION SHOULD BE SENT TO STEVENS, DAVIS, MILLER & MOSHER, L.L.P., 1615 L Street, N.W., Suite 850, Washington, D.C. 20036, TELEPHONE (202) 408-5100, FACSIMILE (202) 408-5200.

See page 2 for signature lines

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful statements may jeopardize the validity of the application or any patent issuing thereon.

PAGE 2 OF U.S.A. DECLARATION FORM

13a	Typewritten Full Name of Sole or First Inventor	**Tadashi**		**YONEZAKI**
		Given Name	Middle Name	Family Name
14a	Inventor's Signature	Tadashi		Yonezaki
15a	Date of Signature	May	10	2001
		Month	Day	Year
16a	Residence	**Yokohama-shi**	**Kanagawa**	**JAPAN**
		City	State or Province	Country
17a	Citizenship	**JAPAN**		
18a	Post Office Address *(Insert complete mailing address, including country)*	**2-2-41-512, Higashiasahina, Kanazawa-ku,**		
		Yokohama-shi, Kanagawa 236-0033 JAPAN		
13b	Typewritten Full Name of Sole or First Inventor			
		Given Name	Middle Name	Family Name
	Inventor's Signature			
	Date of Signature			
		Month	Day	Year
	Residence			
		City	State or Province	Country
	Citizenship			
	Post Office Address *(Insert complete mailing address, including country)*			
	Typewritten Full Name of Sole or First Inventor			
		Given Name	Middle Name	Family Name
	Inventor's Signature			
	Date of Signature			
		Month	Day	Year
1	Residence			
		City	State or Province	Country
17c	Citizenship			
18c	Post Office Address *(Insert complete mailing address, including country)*			
13d	Typewritten Full Name of Sole or First Inventor			
		Given Name	Middle Name	Family Name
14d	Inventor's Signature			
15d	Date of Signature			
		Month	Day	Year
16d	Residence			
		City	State or Province	Country
17d	Citizenship			
18d	Post Office Address *(Insert complete mailing address, including country)*			

*Note to Inventor: Please sign name on line 15 exactly as it appears in line 14 and insert the actual date of signing on line 16. If there are more than four inventors, please add a copy of this page for identification and signatures for the additional inventors.